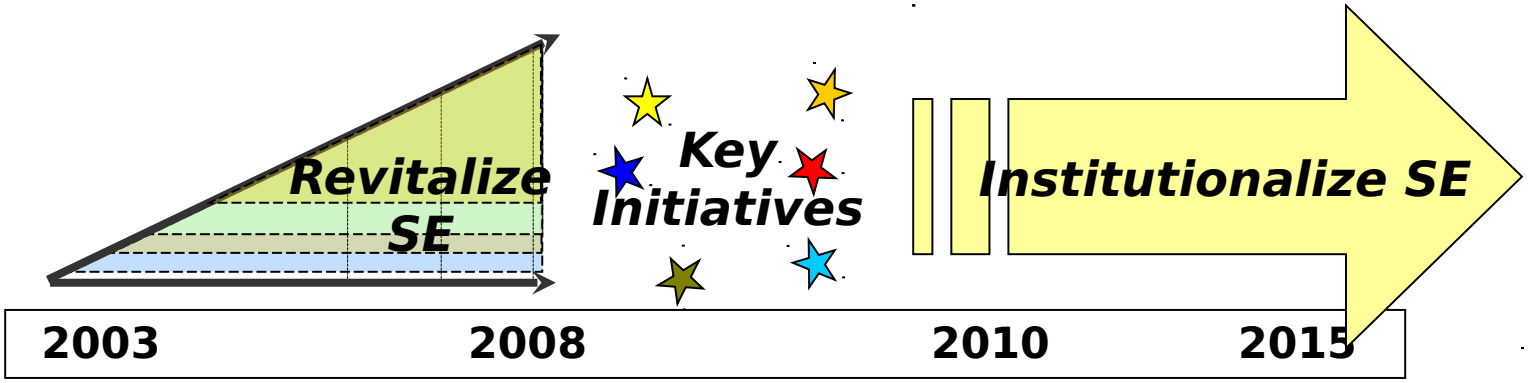
Systems Engineering and Parts Management

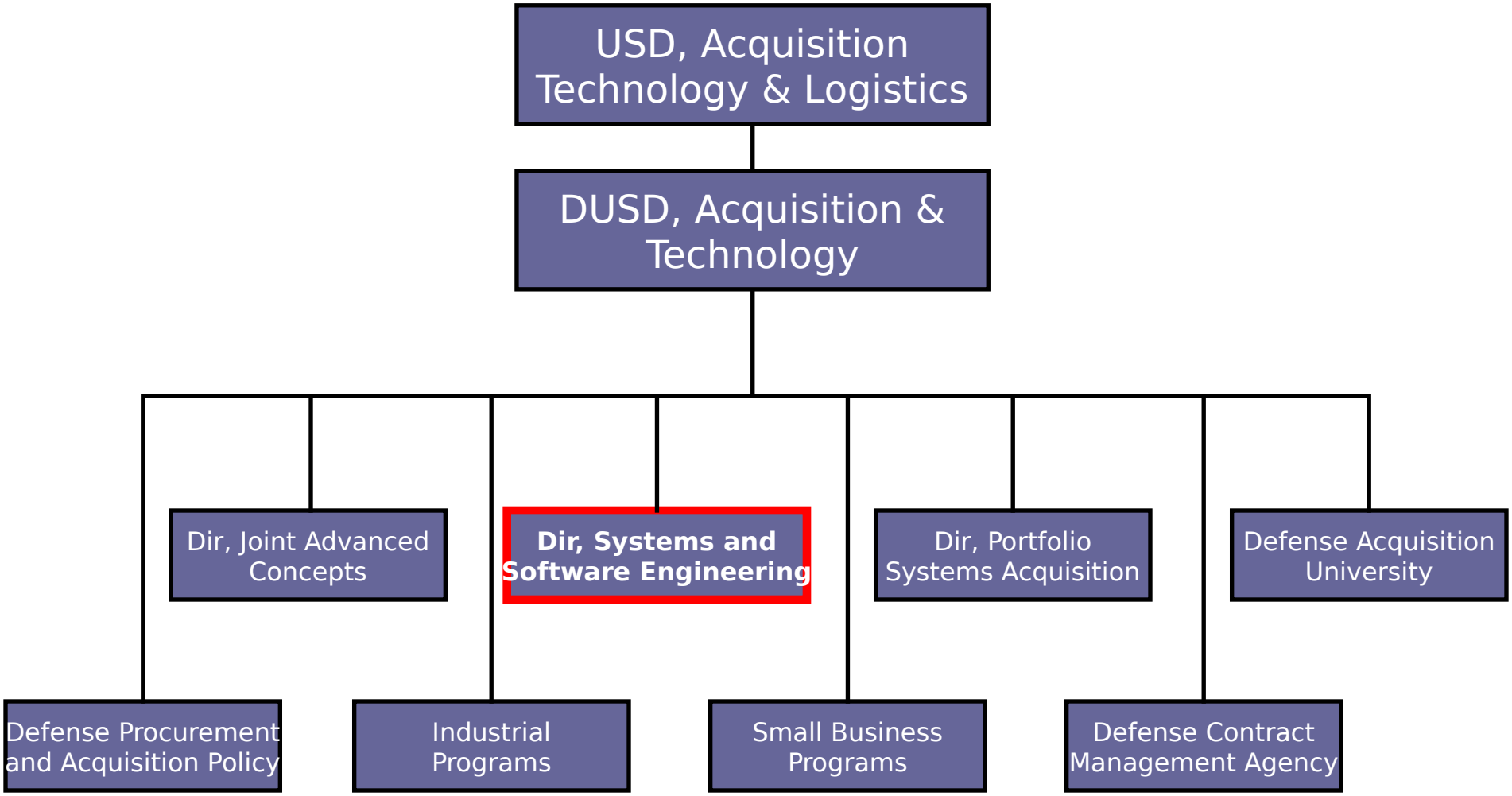
Systems and Software Engineering
Office of the Deputy Under Secretary of Defense (A&T)
PSMC Conference 28 October 2008

Briefing Outline

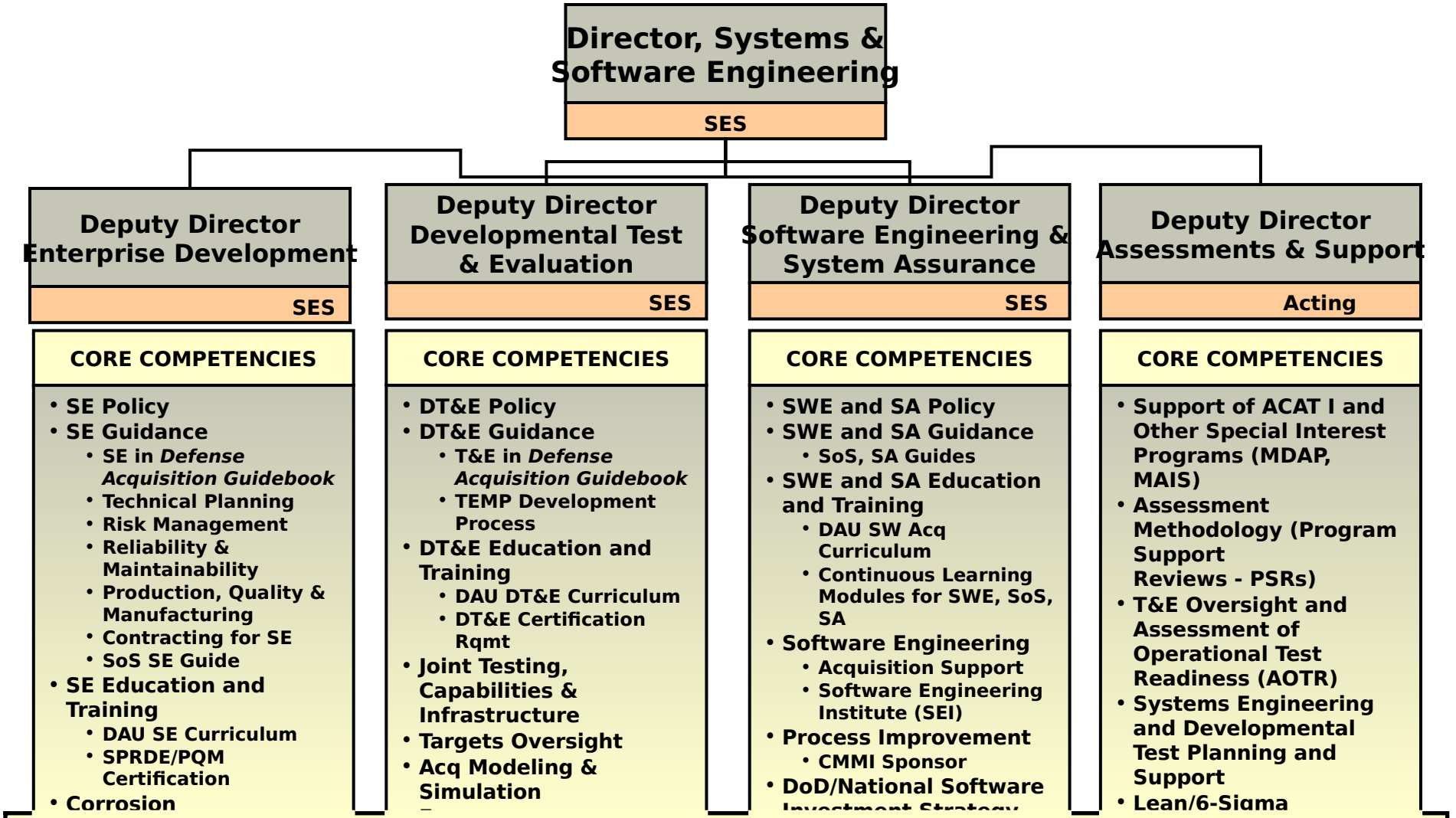
- OSD Systems Engineering Organization and Responsibilities
- Current Issues/Changes
- Parts Management/Logistics



OUSD (AT&L) Organization



Systems and Software Engineering
Organizational Core Competencies

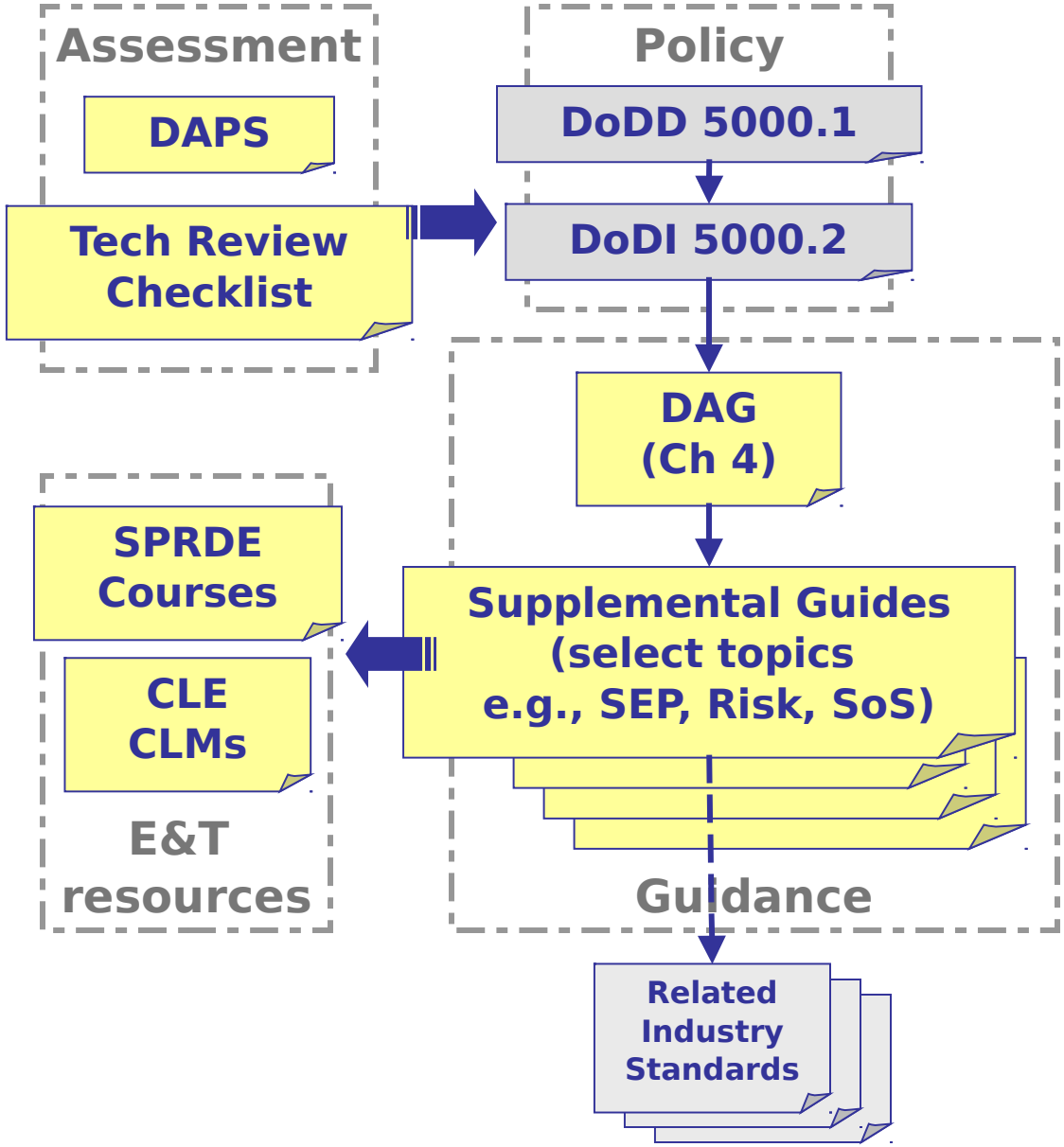

Director, Systems & Software Engineering
SES
Deputy Director Enterprise Development
SES
CORE COMPETENCIES
• SE Policy
• SE Guidance
• SE in *Defense Acquisition Guidebook*
• Technical Planning
• Risk Management
• Reliability & Maintainability
• Production, Quality & Manufacturing
• Contracting for SE
• SoS SE Guide
• SE Education and Training
• DAU SE Curriculum
• SPRDE/PQM Certification
• Corrosion
Deputy Director Developmental Test & Evaluation
SES
CORE COMPETENCIES
• DT&E Policy
• DT&E Guidance
• T&E in *Defense Acquisition Guidebook*
• TEMP Development Process
• DT&E Education and Training
• DAU DT&E Curriculum
• DT&E Certification Rqmt
• Joint Testing, Capabilities & Infrastructure
• Targets Oversight
• Acq Modeling & Simulation
Deputy Director Software Engineering & System Assurance
SES
CORE COMPETENCIES
• SWE and SA Policy
• SWE and SA Guidance
• SoS, SA Guides
• SWE and SA Education and Training
• DAU SW Acq Curriculum
• Continuous Learning Modules for SWE, SoS, SA
• Software Engineering
• Acquisition Support
• Software Engineering Institute (SEI)
• Process Improvement
• CMMI Sponsor
• DoD/National Software
Deputy Director Assessments & Support
Acting
CORE COMPETENCIES
• Support of ACAT I and Other Special Interest Programs (MDAP, MAIS)
• Assessment Methodology (Program Support Reviews - PSRs)
• T&E Oversight and Assessment of Operational Test Readiness (AOTR)
• Systems Engineering and Developmental Test Planning and Support
• Lean/6-Sigma

Acquisition program excellence through sound systems and software engineering

SSE Functions

- Acquisition Program Support
  - Decision Support to Senior DoD Leadership
  - Mentoring Acquisition Programs
  - Technical Reviews of Key Program Documentation
- Policy, Guidance, Best Practices
- Acquisition Workforce Education and Training
  - SE, Test, and Production, Quality and Manufacturing
- Systemic Root Cause Analysis
- “Discipline” Expertise
  - Risk
  - Reliability
  - Architectures
  - Test/Eval
  - CMMI
  - Software
  - Energy
  - Safety
  - Modeling/Simulation
  - Assurance/Cyber
  - Comm/Networking
  - System of Systems

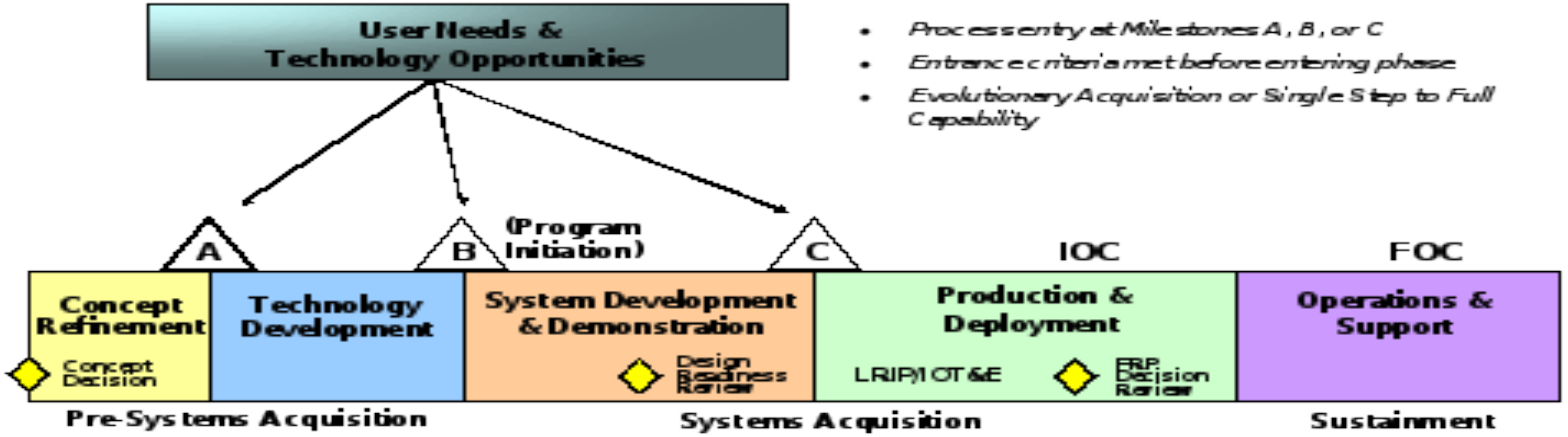
Elements of SE Policy, Education and Training, Guidance and Assessment



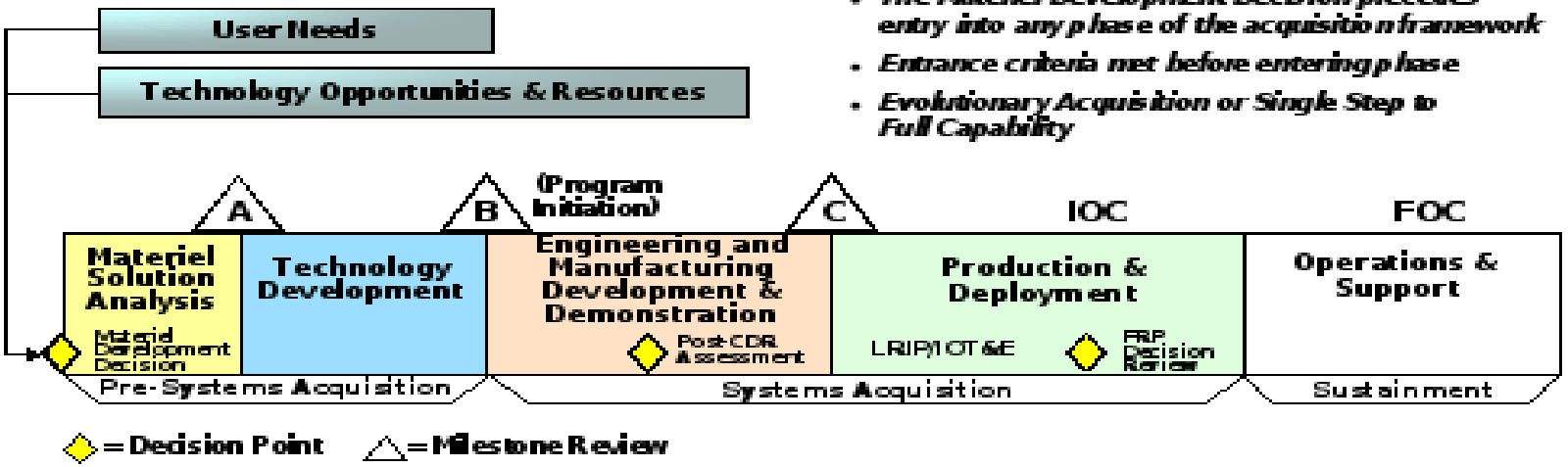
Policy

Subtle, But Substantial Changes

Old Life Cycle

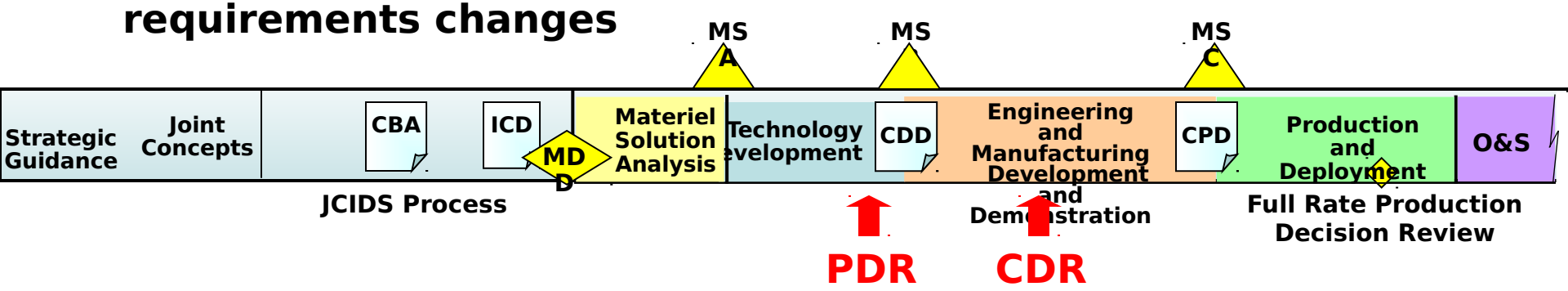


New Life Cycle



Draft Acquisition Policy Changes

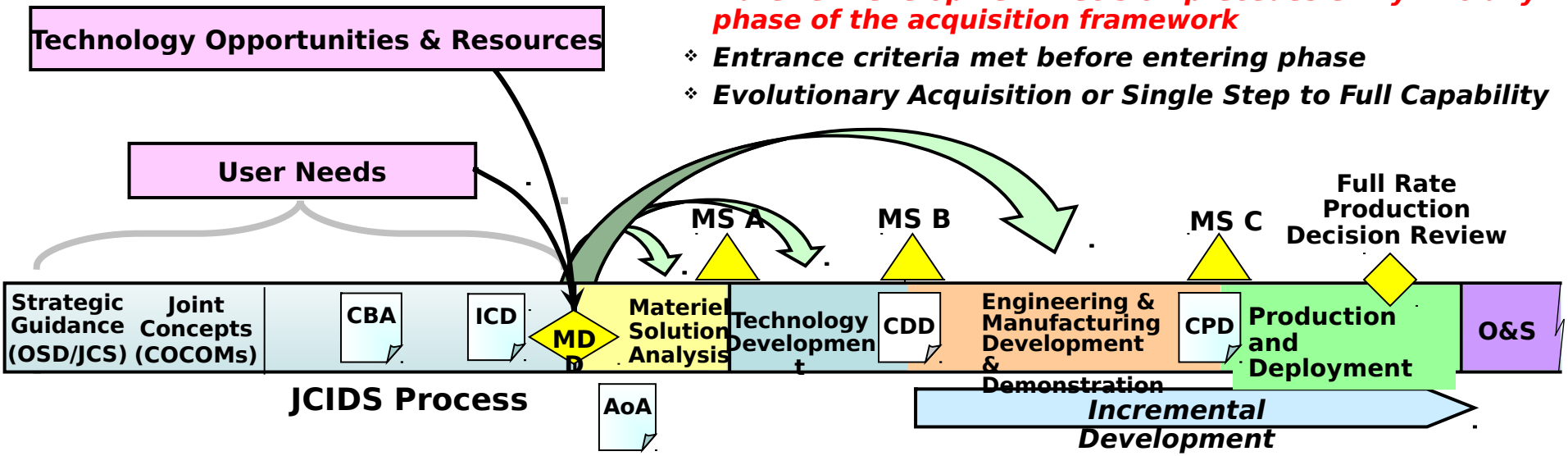
- Mandatory Materiel Development Decision (MDD)
- Mandatory competing prototypes before MS B
- Mandatory PDR and a report to the MDA before MS B (*moves MS B t*
- Configuration Steering Boards at Component level to review all requirements changes



- Renewed emphasis on manufacturing during system development:
  - Re-titles SDD phase to EMDD with two sub phases: Integrated System Design and System Capability and Manufacturing Process Demonstration
  - Establishes consideration of manufacturing maturity at key decision points
- Mandatory system-level CDR with an initial product baseline and followed by

Mandatory Materiel Development Decision

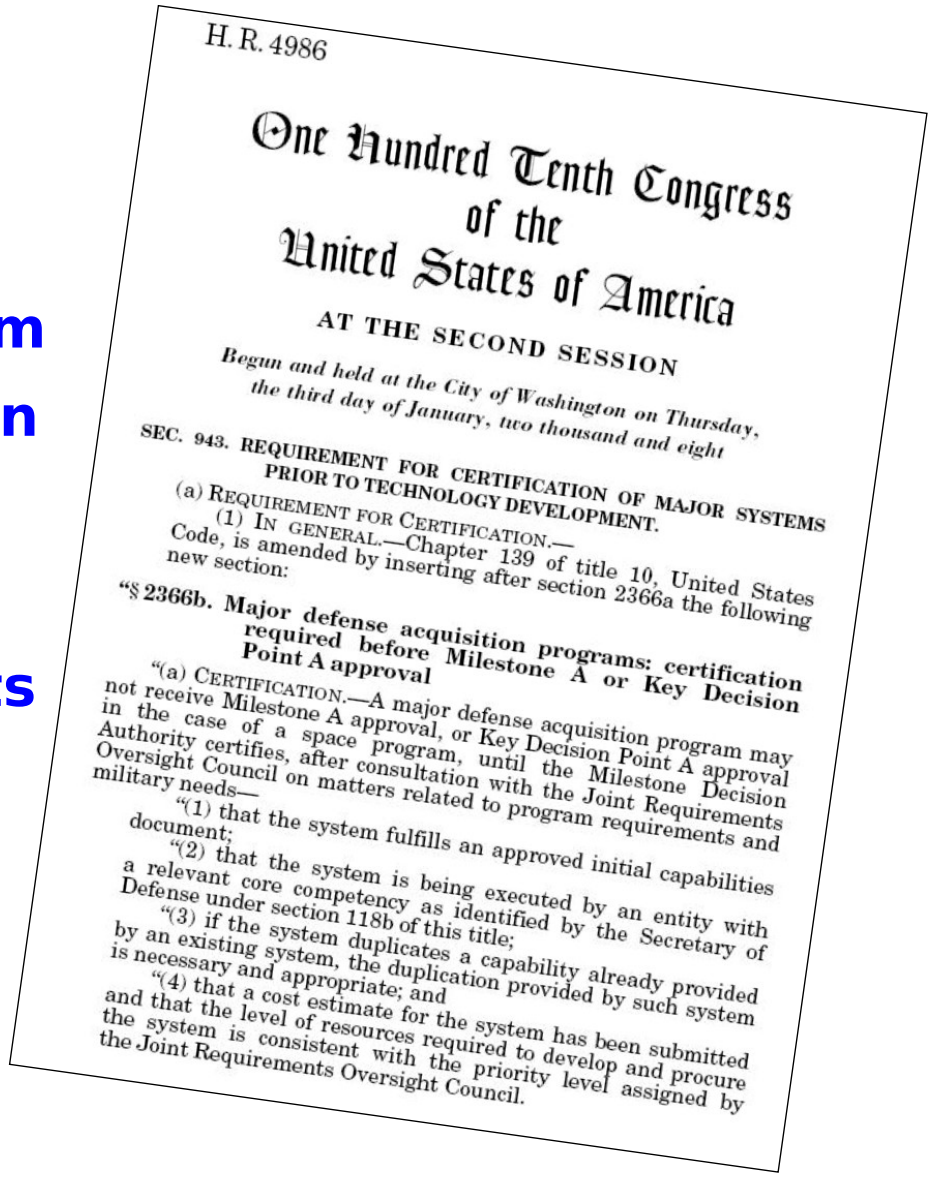
- ***Materiel Development Decision precedes entry into any phase of the acquisition framework***
- ***Entrance criteria met before entering phase***
- ***Evolutionary Acquisition or Single Step to Full Capability***



" When the ICD demonstrates the need for a materiel solution, the JROC will recommend that the MDA consider potential materiel solutions. The MDA, working with appropriate stakeholders, shall determine whether it is appropriate to proceed with a Materiel Development Decision. . . . If the MDA decides that additional analysis is required, a designated office shall prepare, and the MDA shall approve, study guidance to ensure that necessary information is available to support the decision. . . . The Materiel Solution Analysis Phase begins with the Materiel Development Decision (MDD). The MDD is the formal entry point into the acquisition process and shall be mandatory for all programs. . . . At the MDD Review, the Joint Staff shall present the JROC recommendations and the DoD Component shall present the ICD including: the preliminary concept of operations, a description of the needed capability, the operational risk, and the basis for determining that non-materiel approaches will not sufficiently mitigate the capability gap. The Director, PA&E, shall propose study guidance for the AoA. . . . The MDA shall approve the AoA study guidance; determine the acquisition phase of entry; identify the initial review

FY08 National Defense Authorization Act

- **Mandates Milestone A approval prior to technology development for a major weapon system**
- **Requires MDA Certification prior to Milestone A for MDAPs**
- **Changed Milestone B Certification Requirements**
- **Mandates reporting and notification of program cost changes**



H. R. 4986

One Hundred Tenth Congress
of the
United States of America

AT THE SECOND SESSION

Begun and held at the City of Washington on Thursday, the third day of January, two thousand and eight

SEC. 943. REQUIREMENT FOR CERTIFICATION OF MAJOR SYSTEMS PRIOR TO TECHNOLOGY DEVELOPMENT.

(a) REQUIREMENT FOR CERTIFICATION.—
(1) IN GENERAL.—Chapter 139 of title 10, United States Code, is amended by inserting after section 2366a the following new section:

"§ 2366b. Major defense acquisition programs: certification required before Milestone A or Key Decision Point A approval

"(a) CERTIFICATION.—A major defense acquisition program may not receive Milestone A approval, or Key Decision Point A approval in the case of a space program, until the Milestone Decision Authority certifies, after consultation with the Joint Requirements Oversight Council on matters related to program requirements and military needs—

"(1) that the system fulfills an approved initial capabilities document;

"(2) that the system is being executed by an entity with a relevant core competency as identified by the Secretary of Defense under section 118b of this title;

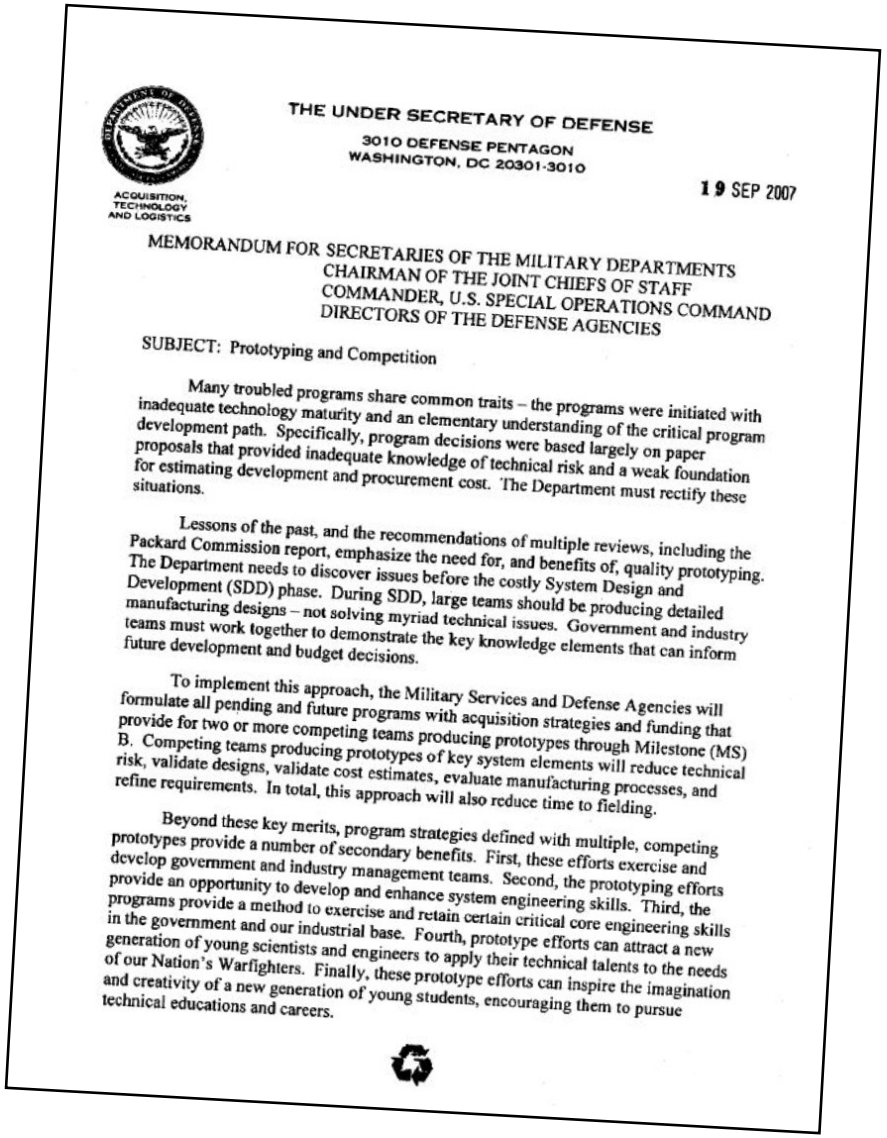
"(3) if the system duplicates a capability already provided by an existing system, the duplication provided by such system is necessary and appropriate; and

"(4) that a cost estimate for the system has been submitted and that the level of resources required to develop and procure the system is consistent with the priority level assigned by the Joint Requirements Oversight Council.

Prototyping and Competition

"Evolutionary acquisition requires . . . Technology development preceding initiation of an increment shall continue until the required level of maturity is achieved, prototypes of the system or key system elements are produced, and a preliminary design is completed. . . ."

"The TDS and associated funding shall provide for two or more competing teams producing prototypes of the system and/or key system elements prior to, or through, Milestone B."



THE UNDER SECRETARY OF DEFENSE
3010 DEFENSE PENTAGON
WASHINGTON, DC 20301-3010

ACQUISITION, TECHNOLOGY AND LOGISTICS

19 SEP 2007

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
COMMANDER, U.S. SPECIAL OPERATIONS COMMAND
DIRECTORS OF THE DEFENSE AGENCIES

SUBJECT: Prototyping and Competition

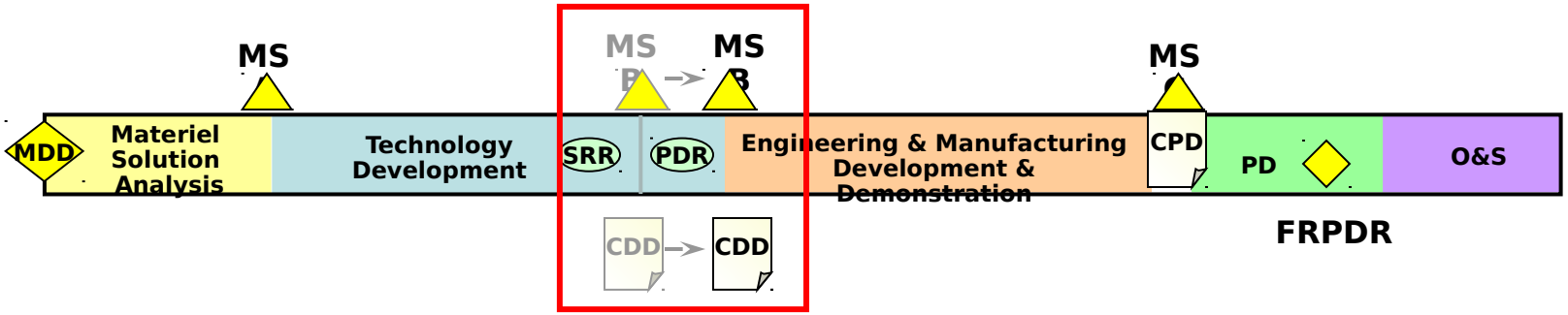
Many troubled programs share common traits – the programs were initiated with inadequate technology maturity and an elementary understanding of the critical program development path. Specifically, program decisions were based largely on paper proposals that provided inadequate knowledge of technical risk and a weak foundation for estimating development and procurement cost. The Department must rectify these situations.

Lessons of the past, and the recommendations of multiple reviews, including the Packard Commission report, emphasize the need for, and benefits of, quality prototyping. The Department needs to discover issues before the costly System Design and Development (SDD) phase. During SDD, large teams should be producing detailed manufacturing designs – not solving myriad technical issues. Government and industry teams must work together to demonstrate the key knowledge elements that can inform future development and budget decisions.

To implement this approach, the Military Services and Defense Agencies will formulate all pending and future programs with acquisition strategies and funding that provide for two or more competing teams producing prototypes through Milestone (MS) B. Competing teams producing prototypes of key system elements will reduce technical risk, validate designs, validate cost estimates, evaluate manufacturing processes, and refine requirements. In total, this approach will also reduce time to fielding.

Beyond these key merits, program strategies defined with multiple, competing prototypes provide a number of secondary benefits. First, these efforts exercise and develop government and industry management teams. Second, the prototyping efforts provide an opportunity to develop and enhance system engineering skills. Third, the programs provide a method to exercise and retain certain critical core engineering skills in the government and our industrial base. Fourth, prototype efforts can attract a new generation of young scientists and engineers to apply their technical talents to the needs of our Nation's Warfighters. Finally, these prototype efforts can inspire the imagination and creativity of a new generation of young students, encouraging them to pursue technical educations and careers.

Preliminary Design Review Precedes MS B



CHARACTERISTICS	MS B moved "to the right" to allow contractor preliminary design to inform requirements, estimated costs, and schedule.
PROCESS	Technology Development extended through formal Preliminary Design Review (PDR). Preliminary design based on DRAFT CDD to facilitate trades before JROC approval. Competitive environment sustained up to and perhaps through MS B. MDA conducts MS B review as described in current policy.
SUPPORTING INFORMATION	PDR Report from PM. Current statutory and regulatory information

BENEFITS

- Ties program decision to event-based (product-based) technical review
- Most derived requirements surfaced
- Better understanding of cost, schedule, and performance risk when the APB is approved and SAR reporting begins
- Opportunity for MDA to defer (in coordination with requirements authority) unachievable requirements to next increment
- Final requirements informed by detailed design
- Early indicator of manufacturing and production issues

New Systems Engineering Enclosure 12

- Codifies three previous SE policy memoranda
- Codifies a number of SE-related policies and Statutes since 2003:
  - Environment, Safety, and Occupational Health
  - Corrosion Prevention and Control
  - Modular Open Systems Approach
  - Data Management and Technical Data Rights
  - Item Unique Identification
  - Reliability, Availability, and Maintainability
- Introduces new policy on Configuration Management

Guidance

Systems and Software Engineering Guidance

- What's available:
  - Systems Engineering Plan (SEP) Preparation Guide, V2
  - Guide to Integrating SE into DoD Acquisition Contracts
  - Risk Management Guide for DoD Acquisition
  - Risk Assessment Technical Review Checklists
  - DoD Guide for Achieving Reliability, Availability, and Maintainability
  - Integrated Master Plan/Integrated Master Schedule (IMP/IMS) Guide
  - Understanding and Leveraging a Supplier's CMMI Efforts: A Guidebook for Acquirers
  - Systems of Systems SE Guide

- What's coming:
  - Update to Defense Acquisition Guidebook
  - Software Assurance Guide

SSE Website: http://www.acq.osd.mil/sse/

Defense Acquisition Guide Update

Ongoing

- **Chapter Authors Revise DAG Based on Most Current Draft of DoDI 5000.02**
- **Drafts of Each Chapter Coordinated "Internally and Externally"**
- **SD-106 Coordination of 5000.02 Complete**
- **Finalized Draft DAG Chapters Sent to DPAP For Comment/Coordination**

Need to Complete

- **New 5000.02 Signed and Delivered to DAU for Posting in .pdf Format on Existing Guidebook Application Website**
- **Initiate and Complete Formal Coordination of Entire DAG**
- **Final DAG Approved and Sent to DAU for Posting in .pdf Format on Existing Guidebook Application Website**
- **DAU Completes Interactive Version of All Documents on New ACC Website**

- **Final On-line Review**

DAG Chapter 4 Changes

- **Overall Structure of the Chapter is Unchanged**
- **Incorporate Changes from DoDI 5000.02 Policy**
- **Promote Early/Enhanced Systems Engineering**
- **Fix Corrections, Omissions and Gain Currency**
- **Seek Consistency with Other DAG Chapters**

DAG Chapter 4 Changes

- 4.1 Systems Engineering in DoD Acquisition
  - Provided overview information on SE leadership, support to PMs, and SE Working-level IPT
- 4.2 Systems Engineering Processes: How Systems Engineering is Conducted
  - Aligned to incorporate relevant updates to ISO/IEC Standard 15288 Systems and software engineering - system life cycle processes
- 4.3 Systems Engineering Activities in the System Life Cycle
  - Materiel Solution Analysis Phase
  - Technology Development Phase (PDR Report)
  - Engineering and Manufacturing Development and Demonstration Phase (CDR Report)
- 4.4 Systems Engineering Execution: Key Systems Engineering Tools and Techniques
  - Updated ‘Design Considerations’ and added Parts Management, DMSMS, Program Protection and System Assurance

Education and Training

SE/PQM Education and Training

- Re-coding of program level engineering specialty positions to Program Systems Engineer (PSE) is in progress across the Services.
  - Added additional training and experience requirements
    - Focus on enhancing SE in the early phases of acquisition
    - Broaden the competency set to include other career fields (e.g., PM, Logistics, Contracting)
    - Double the years of experience required for each DAWIA certification level
- Assisting on DAU’s "Requirements Manager" training curriculum for Joint Staff/Services personnel who develop and manage requirements
- Conducting Systems Engineering Competency Assessment in late 2008/early 2009 for SE and PQM

Parts Management/Logistics

DAG Chapter 4 Proposed Changes to Address Parts Management

- An overview of the goals of Part Management
  - Reduce logistics footprint and lower total life cycle costs
  - Mitigate parts obsolescence due to DMSMS
- What a part is and its relationship to other system elements and CI's
- Discussion of parts management strategy
  - Consideration over the entire life cycle of a system
  - Based on the fundamental SE technical and technical management processes
    - Configuration management, technical assessment, decision analysis, design solution, implementation, verification and evaluation at technical reviews
  - A Parts Management Plan should be documented in the SE Plan
- Parts selection should be based on trade-offs and cost-benefit analysis
- References MIL-STD-3018, SD-19 and industry guides for additional implementation details

Parts Management Considerations for the Updated Defense Acquisition System

- Updated system has a more disciplined AoA process as part of the Materiel Solution Analysis
  - To what extent should there be parts management considerations in the early systems engineering effort?
  - Should parts management be called out in the AoA study plan?

- Updated system has formal competitive prototyping in Technology Development to demonstrate mature technology and performance
  - What is the appropriate parts management role for a technology demonstration? For a prototype? How does it differ?
  - To what extent do parts management considerations differ between a sub-system prototype and a full-system prototype?

- Configuration management responsibilities not fully defined in a competitive prototyping environment
  - How does this affect parts management?

Reliability

Background

- DUSD(A&T) Memo,15 Feb 08 requested CAEs establish a Reliability Improvement Working Group (RIWG) to:
  - Ensure programs are formulated to execute a viable systems engineering strategy from the beginning, including a RAM growth program, as an integral part of design and development.
  - Ensure government organizations reconstitute a cadre of experienced T&E and RAM personnel
  - Implement mandated integrated DT and OT, including the sharing and access to

    all appropriate contractor and government data and the use of operationally

    representative environments in early testing.

- Final Report of the DSB Task Force on Development Test and Evaluation, 27 May 08
  - Recommended that RAM, including a robust reliability program with an established reliability growth approach, be a mandatory contractual requirement and be addressed at every major program review.

Reliability

USD(AT&L) Memo to SAEs, 21 July 08

- Directed Components to establish a reliability improvement acquisition policy; and report back in 30 days
- Component Policy shall:
  - Ensure effective collaboration between the requirements and acquisition communities in the establishment of RAM requirements that balance funding and schedule while ensuring system suitability and effectiveness in the anticipated operating environment.
  - Ensure development contracts and acquisition plans evaluate RAM during system design.
  - Evaluate the maturation of RAM through each phase of the acquisition life cycle.
  - Evaluate the appropriate use of contract incentives to achieve RAM objectives.
- Established DoD policy:
  - Programs execute a viable RAM strategy that includes a reliability growth program as an integral part of design and development.
  - RAM shall be integrated within the Systems Engineering processes, documented in the program's Systems Engineering Plan and Life Cycle Sustainment Plan, and assessed during technical reviews, test and evaluation, and Program Support Reviews.

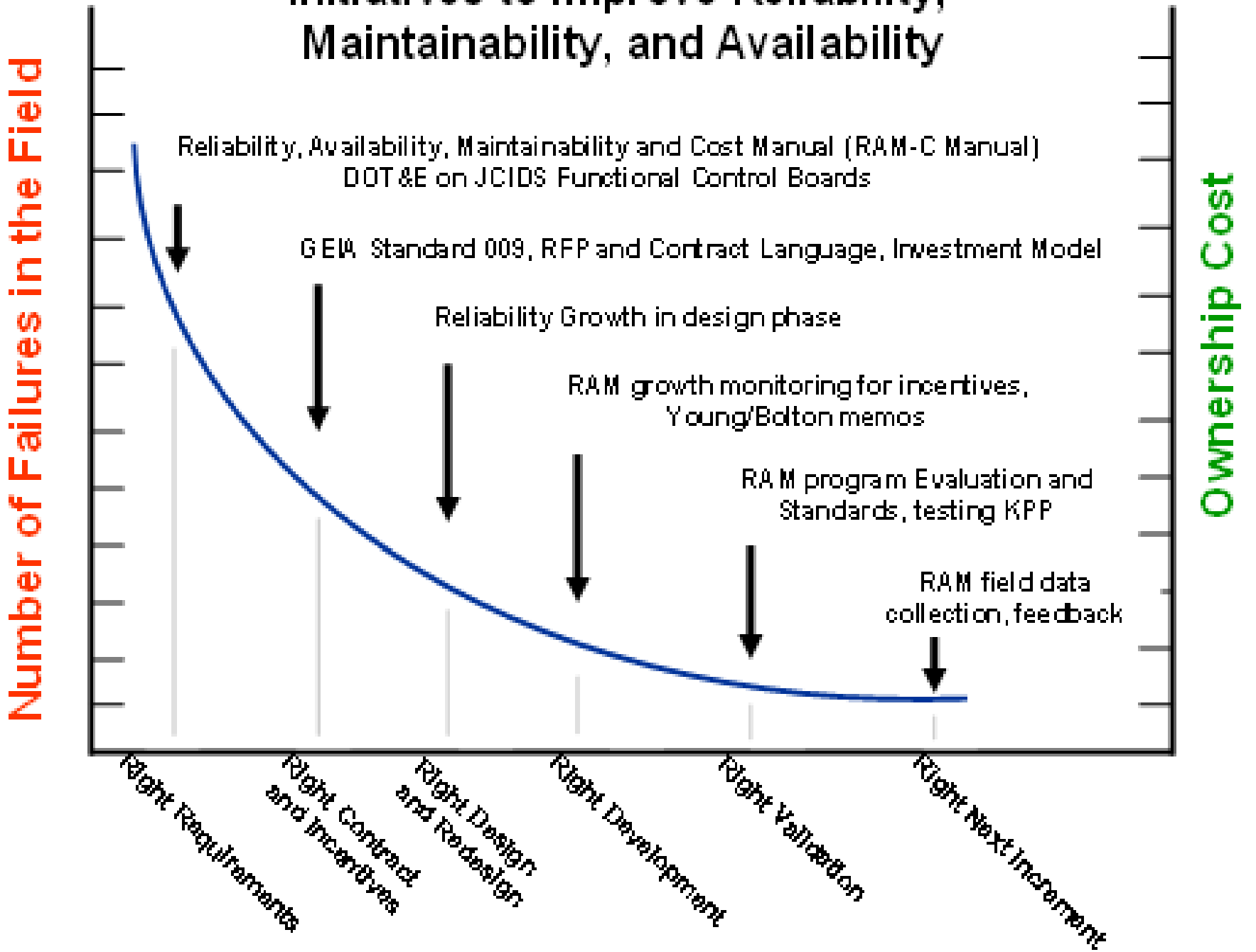
Reliability

RIWG Report

- Ensure programs are formulated to execute a viable systems engineering strategy from the beginning, including a RAM growth program, as an integral part of design and development.
  - **Establish Reliability Improvement Policy**
  - **Develop Sample Reliability Language for Acquisition Contracts**
  - **Guidance for Early RAM Planning**
  - **Define Standard Criteria to Evaluate a Reliability Program**
  - **Designate Reliability Champions Across DoD**

- Ensure government organizations reconstitute a cadre of experienced T&E and RAM Personnel
  - **Establish policy to enable RAM and T&E workforce reconstitution**
  - **Assure current Training and Education for the workforce**

- Implement mandated integrated DT and OT, including the sharing and access to all appropriate contractor and government data and the use of operationally representative environments in early testing.
  - **Guide on Incorporating T&E in Acquisition Contracts**
  - **Draft DAG Chapter 9 Integrated Testing content and TEMP update complete**
  - **RIWG Chairs requested formal response to Integrated Test efforts**


Initiatives to Improve Reliability, Maintainability, and Availability
Number of Failures in the Field
Ownership Cost
Reliability, Availability, Maintainability and Cost Manual (RAM-C Manual)
DOT&E on JCIDS Functional Control Boards
GEIA Standard 009, RFP and Contract Language, Investment Model
Reliability Growth in design phase
RAM growth monitoring for incentives, Young/Bolton memos
RAM program Evaluation and Standards, testing KPP
RAM field data collection, feedback
Right Requirements
Right Contract and Incentives
Right Design and Redesign
Right Development
Right Validation
Right Next Increment

Product Support Assessment Team

- **Team Stood Up in Early October 08**
- **Will Identify Areas to Recommend What Initiatives That L&MR Should Be Focusing On**
- **Goal is to Provide Direction to Incoming AT&L**

Summary

- Many initiatives are flowing down from OSD
- SSE working to ensure Parts Management becomes properly integrated with systems engineering and acquisition program oversight
  - Incorporation into Systems Engineering chapter of Defense Acquisition Guide
  - Incorporation as consideration in Technical Planning
  - Participation on various documents to assist the acquisition community to better address Parts Management (i.e. Risk Checklists, MIL-STD-3018, CLM, SD-19)